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Three-dimensional tomographic reconstruction and MHD modeling of the low Corona during the last three solar minima

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Interest in predicting space weather is constantly pushes the advance of three-dimensional (3D) magnetohydrodynamic (MHD) models of the corona and solar wind, which in turn need to be validated with observational data. Solar rotational tomography (SRT) is currently the only observational technique capable of providing an empirical 3D description of the coronal thermodynamic structure on a global scale. We have systematically applied SRT to images provided by three generations of space telescopes to perform coronal tomographic reconstructions during the last three minima of solar activity (years 1996, 2008, 2019). During them, the large-scale organization of the corona-wind system is as simple as possible, revealing more clearly the differences between the closed (streamers) and open (coronal holes) structures, as well as between the fast and slow components of the solar wind. In particular, the last three minima are of particular interest since they belong to solar cycles during which the level of activity decreased systematically. Applied to images in multiple bands of the EUV range, the SRT allows to reconstruct the 3D distribution of the density and temperature of the corona in the range of heliocentric heights r<1.25 R_sun, while applied Coronagraph images in visible light allow us to reconstruct the 3D distribution of coronal density in the range r=2.5-6.0 R_sun. These ranges constitute the region in which the heating and acceleration of the solar wind occurs. For the periods studied we have also carried out numerical simulations based on the MHD-3D model of the corona and solar wind named Alfvén Wave Solar atmosphere Model (AWSoM), in order to carry out systematic validation studies. In this work

we synthesize the most outstanding results regarding the comparison of the coronal structure between the minimum, validation of the AWSoM simulations, and the relationship between the coronal thermodynamic structure and the components of the solar wind.